Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the above-captioned application:

Listing of Claims:

1.–100. (canceled)

101. (currently amended) A method of making a polymer nanocomposite comprising:

combining a polymer dispersion with a clay mineral dispersion to form a clay-polymer dispersion, wherein the polymer dispersion comprises a negatively charged polymer<u>, and wherein the clay-polymer dispersion comprises less than 90% by weight of clay with respect to the weight of polymer in the clay-polymer dispersion</u>; and

adding a flocculating agent to the clay-polymer dispersion mixture to form the polymer nanocomposite, wherein the flocculating agent comprises a positively charged compound.

102. (previously presented) The method of claim 101, wherein the polymer dispersion comprises less than 80% by weight of the negatively charged polymer.

103. (previously presented) The method of claim 101, wherein the negatively charged polymer comprises styrene-butadiene latex.

104. (previously presented) The method of claim 101, wherein the negatively charged polymer comprises latex.

105. (previously presented) The method of claim 101, wherein the clay mineral dispersion comprises montmorillonite.

106. (previously presented) The method of claim 101, wherein the clay mineral dispersion comprises bentonite.

107. (previously presented) The method of claim 101, wherein the clay mineral dispersion comprises hectorite, saponite, attapulgite, beidellite, stevensite, sauconite, nontronite, Laponite, or sepiolite.

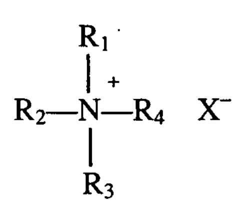
108. (currently amended) The method of claim 101, wherein the clay mineral dispersion comprises from about 1% to about 10% by weight of the clay mineral.

109. (previously presented) The method of claim 101, further comprising forming the clay mineral dispersion by subjecting a mixture of the clay mineral in a liquid carrier to a high shear process.

110. (previously presented) The method of claim 101, wherein the clay-polymer dispersion comprises less than 30% by weight of clay mineral with respect to the weight of the negatively charged polymer in the clay-polymer dispersion.

111. (previously presented) The method of claim 101, wherein the flocculating agent comprises a quaternary ammonium compound.

112. (previously presented) The method of claim 101, wherein the flocculating agent comprises a quaternary ammonium compound having the structure:



wherein R_1, R_2, R_3, and R_4 are independently alkyl groups, aryl groups or arylalkyl groups, and wherein at least one of R_1, R_2, R_3, or R_4 is an aliphatic group derived from a naturally occurring oil.

113. (previously presented) The method of claim 101, wherein the flocculating agent comprises between about 1% to about 10% by weight of the clay-polymer dispersion.

114. (previously presented) The method of claim 101, wherein the flocculating agent comprises hydrotalcite.

115. (previously presented) The method of claim 101, wherein the clay mineral dispersion comprises montmorillonite and wherein the flocculating agent comprises hydrotalcite.

116. (currently amended) A polymer nanocomposite made by the method comprising:

combining a polymer dispersion with a clay mineral dispersion to form a clay-polymer dispersion, wherein the polymer dispersion comprises a negatively charged polymer, and wherein the clay-polymer dispersion comprises less than 90% by weight of clay with respect to the weight of polymer in the clay-polymer dispersion; and

adding a flocculating agent to the clay-polymer dispersion mixture to form the polymer nanocomposite, wherein the flocculating agent comprises a positively charged compound.

117. (previously presented) The polymer nanocomposite of claim 116, wherein the polymer dispersion comprises less than 80% by weight of the negatively charged polymer.

118. (previously presented) The polymer nanocomposite of claim 116, wherein the negatively charged polymer comprises styrene-butadiene latex.

119. (previously presented) The polymer nanocomposite of claim 116, wherein the negatively charged polymer comprises latex.

120. (previously presented) The polymer nanocomposite of claim 116, wherein the clay mineral dispersion comprises montmorillonite.

121. (previously presented) The polymer nanocomposite of claim 116, wherein the clay mineral dispersion comprises bentonite.

122. (previously presented) The polymer nanocomposite of claim 116, wherein the clay mineral dispersion comprises hectorite, saponite, attapulgite, beidellite, stevensite, sauconite, nontronite, Laponite, or sepiolite.

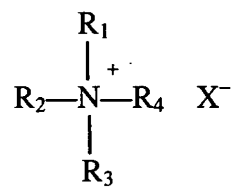
123. (currently amended) The polymer nanocomposite of claim 116, wherein the clay mineral dispersion comprises from about 1% to about 10% by weight of the clay mineral.

124. (previously presented) The polymer nanocomposite of claim 116, wherein the method further comprises forming the clay mineral dispersion by subjecting a mixture of the clay mineral in a liquid carrier to a high shear process.

125. (previously presented) The polymer nanocomposite of claim 116, wherein the clay-polymer dispersion comprises less than 30% by weight of clay mineral with respect to the weight of the negatively charged polymer in the clay-polymer dispersion.

126. (previously presented) The polymer nanocomposite of claim 116, wherein the flocculating agent comprises a quaternary ammonium compound.

127. (previously presented) The polymer nanocomposite of claim 116, wherein the flocculating agent comprises a quaternary ammonium compound having the structure:



wherein R_1, R_2, R_3, and R_4 are independently alkyl groups, aryl groups or arylalkyl groups, and wherein at least one of R_1, R_2, R_3, or R_4 is an aliphatic group derived from a naturally occurring oil.

128. (previously presented) The polymer nanocomposite of claim 116, wherein the flocculating agent comprises between about 1% to about 10% by weight of the clay-polymer dispersion.

129. (previously presented) The polymer nanocomposite of claim 116, wherein the flocculating agent comprises hydrotalcite.

130. (previously presented) The polymer nanocomposite of claim 116, wherein the mineral clay mineral dispersion comprises montmorillonite and wherein the flocculating agent comprises hydrotalcite.

131. (previously presented) A method of making a polymer nanocomposite comprising:

combining a polymer dispersion with a clay mineral dispersion to form a clay-polymer dispersion; wherein the clay-polymer dispersion comprises less than 90% by weight of clay mineral with respect to the weight of the polymer in the clay-polymer dispersion; and

adding a flocculating agent to the clay-polymer dispersion mixture to form the polymer nanocomposite.

132. (previously presented) The method of claim 131, wherein the polymer dispersion comprises latex.

133. (previously presented) The method of claim 131, wherein the polymer dispersion comprises polyvinyl chloride, a chlorosulfonated polyethylene rubber, a fluoroeleastomer, or polyisoprene.

134. (previously presented) The method of claim 131, wherein the polymer dispersion comprises less than 80% by weight of the polymer.

135. (previously presented) The method of claim 131, wherein the clay mineral dispersion comprises montmorillonite.

136. (previously presented) The method of claim 131, wherein the clay mineral dispersion comprises bentonite.

137. (previously presented) The method of claim 131, wherein the clay mineral dispersion comprises hectorite, saponite, attapulgite, beidellite, stevensite, sauconite, nontronite, Laponite, or sepiolite.

138. (previously presented) The method of claim 131, wherein the clay mineral dispersion comprises hydrotalcite.

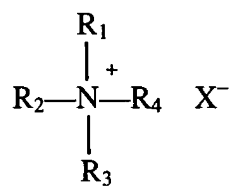
139. (currently amended) The method of claim 131, wherein the clay mineral dispersion comprises from about 1% to about 10% by weight of the clay mineral.

140. (previously presented) The method of claim 131, further comprising forming the clay mineral dispersion by subjecting a mixture of the clay mineral in a liquid carrier to a high shear process.

141. (previously presented) The method of claim 131, wherein the clay-polymer dispersion comprises less than 30% by weight of clay mineral with respect to the weight of polymer in the clay-polymer dispersion.

142. (previously presented) The method of claim 131, wherein the flocculating agent comprises a quaternary ammonium compound.

143. (previously presented) The method of claim 131, wherein the flocculating agent comprises a quaternary ammonium compound having the structure:



wherein R_1, R_2, R_3, and R_4 are independently alkyl groups, aryl groups or arylalkyl groups, and wherein at least one of R_1, R_2, R_3, or R_4 is an aliphatic group derived from a naturally occurring oil.

144. (previously presented) The method of claim 131, wherein the flocculating agent comprises between about 1% to about 10% by weight of the clay-polymer dispersion.

145. (previously presented) The method of claim 131, wherein the flocculating agent comprises hydrotalcite.

146. (previously presented) A polymer nanocomposite made by a method comprising:

combining a polymer dispersion with a clay mineral dispersion to form a clay-polymer

dispersion; wherein the clay-polymer dispersion comprises less than 90% by weight of clay mineral with respect to the weight of the polymer in the clay-polymer dispersion; and

adding a flocculating agent to the clay-polymer dispersion mixture to form the polymer nanocomposite.

147. (previously presented) The polymer nanocomposite of claim 146, wherein the polymer dispersion comprises latex.

148. (previously presented) The polymer nanocomposite of claim 146, wherein the polymer dispersion comprises polyvinyl chloride, a chlorosulfonated polyethylene rubber, a fluoroeleastomer, or polyisoprene.

149. (previously presented) The polymer nanocomposite of claim 146, wherein the polymer dispersion comprises less than 80% by weight of the polymer.

150. (previously presented) The polymer nanocomposite of claim 146, wherein the clay mineral dispersion comprises montmorillonite.

151. (previously presented) The polymer nanocomposite of claim 146, wherein the clay mineral dispersion comprises bentonite.

152. (previously presented) The polymer nanocomposite of claim 146, wherein the clay mineral dispersion comprises hectorite, saponite, attapulgite, beidellite, stevensite, sauconite, nontronite, Laponite, or sepiolite.

153. (previously presented) The polymer nanocomposite of claim 146, wherein the clay mineral dispersion comprises hydrotalcite.

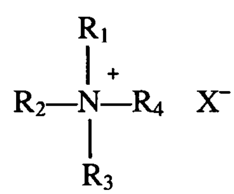
154. (currently amended) The polymer nanocomposite of claim 146, wherein the clay mineral dispersion comprises from about 1% to about 10% by weight of the clay mineral.

155. (previously presented) The polymer nanocomposite of claim 146, further comprising forming the clay mineral dispersion by subjecting a mixture of the clay mineral in a liquid carrier to a high shear process.

156. (previously presented) The polymer nanocomposite of claim 146, wherein the clay-polymer dispersion comprises less than 30% by weight of clay mineral with respect to the weight of polymer in the clay-polymer dispersion.

157. (previously presented) The polymer nanocomposite of claim 146, wherein the flocculating agent comprises a quaternary ammonium compound.

158. (previously presented) The polymer nanocomposite of claim 146, wherein the flocculating agent comprises a quaternary ammonium compound having the structure:



wherein R_1, R_2, R_3, and R_4 are independently alkyl groups, aryl groups or arylalkyl groups, and wherein at least one of R_1, R_2, R_3, or R_4 is an aliphatic group derived from a naturally occurring oil.

159. (previously presented) The polymer nanocomposite of claim 146, wherein the flocculating agent comprises between about 1% to about 10% by weight of the clay-polymer dispersion.

160. (previously presented) The polymer nanocomposite of claim 146, wherein the flocculating agent comprises hydrotalcite.

Remarks/Arguments

A. Claims in the Case

Claims 101-160 are pending. Claims 101, 102, 104-113, 116, 117, 119-128, 131-137, 139-147, 149-152 and 154-159 are rejected. Claims 101, 108, 116, 123, 139 and 154 have been amended.

B. Amendments

The Examiner states, "the applicants are also requested, per rules of the MPEP to insert the domestic priority date at the beginning of the specification." Applicant submits that the specification has been amended to include the priority date for the above-captioned application. Furthermore, Applicant submits no new matter was added to the specification.

C. The Claims Are Not Anticipated by Ross et al. et al. Pursuant To 35 U.S.C. § 102(e)

The Examiner rejected claims 131,132, 134-137, 139, 141-144, 146, 147, 149-152, 154, and 156-159 under 35 U.S.C. § 102(e) as being unpatentable over U.S. Patent No. 6,380,295 to Ross et al. (hereinafter "Ross").

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed.Cir. 1986); *In re Donahue*, 766 F.2d 531, 226 U.S.P.Q. 619, 621 (Fed.Cir. 1985).

Claims 131 and 146 include a combination of features including, but not limited to, the feature of,

> combining a polymer dispersion with a clay mineral dispersion to form a clay-polymer dispersion; wherein the clay-polymer dispersion comprises less than 90% by weight of clay mineral with respect to the weight of the polymer in the clay-

polymer dispersion

Applicant submits that Ross does not appear to teach or suggest the combination of the features of the claims. Ross does not appear to teach a clay dispersion that includes an amount of polymer being greater than the amount of clay. Instead, Ross appears to teach a clay/chemical composition that includes an amount of clay that is greater than an amount of polymer. For example, Ross states,

> One important aspect of the invention is a clay/organic chemical composition....obtained by the intercalation and reaction of
> a) one or more smectite clays;
> b) one or more quaternary ammonium compounds; and
> c) one or more non-anionic organic materials.
> (Ross, column 4, lines 57-63).
>
> Material suitable for element (c) of this invention include polyurethanes; polyamides; polyesters; polycarbonates polyepoxides and polyolefins. Such materials also include polyethers (polymers and copolymers).....
> (Ross, column 8, lines 5-24).
>
> The ratio of component (c) to component (a) clay will be at least 5:100 to 80:100....
> (Ross, column 9, lines 3-10).
>
> ...1350 g of a prehydrated aqueous hectorite clay slurry (concentration of clay = 2.8%)....Non-anionic organic material, as shown below, at a level of 30% based on calculated clay weight.
> (Ross, Column 10, lines 31-34).

Applicant submits that Ross does not appear to teach or suggest the features of clay including, but not limited to, the feature of the amount of clay being "less than 90% by weight of clay mineral with respect to the weight of the polymer in the clay-polymer dispersion". As such, Applicant submits that claims 131, 146 and the dependent claims thereon (claims 132-145 and 147-160, respectively) are patentable over Ross.

D. <u>The Claims Are Not Anticipated by Powell et al. et al. Pursuant To 35 U.S.C. § 102(e)</u>

The Examiner rejected claims 101, 102, 104-113, 116, 117, 119-128, 131, 132, 134-137, 139-144, 146, 147, 149-152, and 154-149 under 35 U.S.C. § 102(e) as being unpatentable over U.S. Patent No. 6,271,298 to Powell et al. (hereinafter "Powell").

Claims 131, 146, 101, and 116 include a combination of features including, but not limited to the features of, "combining a polymer dispersion with a clay mineral dispersion to form a clay-polymer dispersion" and "wherein the clay-polymer dispersion comprises less than 90% by weight of clay with respect to the weight of polymer in the clay-polymer dispersion." Support for the amendment to claims 101 and 116 can be found in original claim 19 of Applicant's specification.

Applicant submits that Powell does not teach or suggest at least the feature of the claim, "wherein the clay-polymer dispersion comprises less than 90% by weight of clay with respect to the weight of polymer in the clay-polymer dispersion".

The Office Action states that:

> According to the process of Powell the clay is first treated with anionic polymer of the acrylate family, subjected to high shear and then treated with quaternary ammonium compound. According to Table 1 (col. 4) the amount of clay is less than 10% by weight. The anionic polymer is utilized in amount of clay less than 10 % by weight. The anionic polymer is utilized in amount of 0.1-1.0% by weight of clay (col. 3, lines 1-5).
> (Office Action, page 3)

Applicant respectfully disagrees with the Office Action's characterization of Powell. Powell is directed to a process of edge treating clays with negatively charged organic molecules. For example, Powell states:

> The polyacrylate which is used to coat the clay edges is applied to the mineral prior to the high shearing step. The polyacrylate is added at a dosage rate of about 0.1 to 1.0% by weight of the dry clay, with 0.5% by weight being typical. Following the shearing the excess charge on the edges as well as the clay surface charge may be reacted with the quaternary. Among typical polyacrylates which

> may be used are the Alcogum SL-76 or SL-78 products of Alco Chemical Division of National Starch and Chemical Company, the JARCO M-25B product of Jarco Chemical Co., and various polyacrylate products of Allied Colloids.

Thus, Powell teaches treating a clay mineral with between about 0.1 to 1.0% of an negatively charged organic compound to form an edge treated clay mineral. After shearing the clay may be treated with a quaternary ammonium compound.

In this manner, a clay is obtained that may be used in a clay-polymer nanocomposite. Examples of the use of polymer treated clay to from a nanocomposite are described in Examples 1-8. Examples 1-8 describe the use of eight different treated clays in the processing of a nylon resin. With respect to the preparation of the clay for these Examples, Powell states:

> In preparing the samples, purified slurries of the montmorillonite clay were either mixed or not mixed with a polyacrylate of the type described above, and the samples were then subjected to high shear by being passed as dilute aqueous slurries through an MG mill. With two exceptions the sheared samples were then treated with an alkyl quaternary ammonium compound. The quaternary compound used for these latter samples was a branched chain quaternary ammonium compound of the type disclosed in U.S. Pat. No. 5,739,087, more specifically being a dimethyl hydrogenated tallow -2-ethyl hexyl ammonium methylsulfate. The treated slurries were then dewatered, and the resulting clay cake was dried and ground.

In the above-cited section Powell describes a process of treating a clay (montmorillonite) with an anionic organic polymer (polyacrylate). Applicant submits that the amount of polyacrylate is used, as described in the previously cited section, is "between 0.1 to 1.0% by weight of the dry clay, with 0.5% being typical." The resulting clay is dewatered, dried and ground.

After the treated clay is prepared, the clay is dispersed in nylon 6,6, resin. Powell states:

> Eight nanocomposite samples A through H were prepared in which a mineral clay was dispersed in a nylon 6,6 resin matrix.
> (Powell, col. 4, lines 11-13)

> The treated slurries were then dewatered, and the resulting clay cake was dried and

> ground. In each instance the resulting powder was mixed with pellets of the polymer, melted and blended in an O-M twin screw mixer-extruder, and the extruded samples were permitted to solidify. The final resulting samples were then subjected to wide angle X-ray microscopy (WAX).
> (Powell, col. 4, lines 24-29)

Powell teaches that the treated clays (the clays that have been treated with an anionic polymer and dried) are then mixed with a polymer (in the cited example, nylon 6,6) to form a nanocomposite.

Applicant submits that Powell does not teach or suggest the combination of the features of the claim including, but not limited to, the feature of, "wherein the clay-polymer dispersion comprises less than 90% by weight of clay with respect to the weight of polymer in the clay-polymer dispersion." Powell, instead, teaches that a clay dispersion is treated with 0.1 to 1.0 % by weight of a negatively charged organic compound with respect to the dry clay weight. As such, Applicant submits that claims 101, 116, 131, and 146 and the claims dependent thereon (claims 102-115, 117-130, 132-145 and 147-160, respectively) are patentable over Powell.

E. Many Of The Dependent Claims Are Separately Patentable

The Examiner is also respectfully requested to separately consider each of the dependent claims for patentability. Many of the dependent claims in addition to those mentioned above are independently patentable.

For instance, claims 102, 117, 134 and 149 state in part, "wherein the polymer dispersion comprises less than 80% by weight of the negatively charged polymer." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 104, 119, 132, and 147 state in part, "wherein the polymer dispersion comprises latex." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 105, 120, 135 and 150 state in part, " wherein the clay mineral dispersion comprises montmorillonite." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 106, 121, 136 and 151 state in part, "wherein the clay mineral dispersion comprises bentonite." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 107, 122, 137 and 152 state in part, "wherein the clay mineral dispersion comprises hectorite, saponite, attapulgite, beidellite, stevensite, sauconite, nontronite, Laponite, or sepiolite." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Amended claims 108, 123, 139 and 154 state in part, "wherein the clay mineral dispersion comprise from about 1% to about 10% by weight of the clay mineral." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

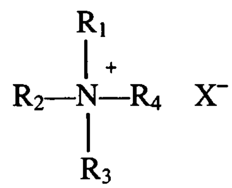
Claims 109, 124, 140, and 155 state in part, "forming the clay mineral dispersion by subjecting a mixture of the clay mineral in a liquid carrier to a high shear process." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 110, 125, 141, and 156 state in part, "wherein the clay-polymer dispersion comprises less than 30% by weight of clay mineral with respect to the weight of polymer n the clay-polymer dispersion." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be

taught or suggested by the cited art.

Claims 111, 126, 142, 157 state in part, " wherein the flocculating agent comprises a quaternary ammonium compound." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 112, 127, 143, and 158 state in part, "wherein the flocculating agent comprises a quaternary ammonium compound having the structure:



wherein R_1, R_2, R_3, and R_4 are independently alkyl groups, aryl groups or arylalkyl groups, and wherein at least one of R_1, R_2, R_3, or R_4 is an aliphatic group derived from a naturally occurring oil." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.

Claims 113, 128, 144, and 159 state in part, "wherein the flocculating agent comprises between about 1% to about 10% by weight of the clay-polymer dispersion." Applicant submits the features of the claims, in combination with the features of the independent claims 101, 116, 131 and 146, respectively, do not appear to be taught or suggested by the cited art.